ENERGY, WORK & POWER

AP Extras & Examples

QUESTIONS ON VIDEOS?

SPRINGS & ELASTIC ENERGY

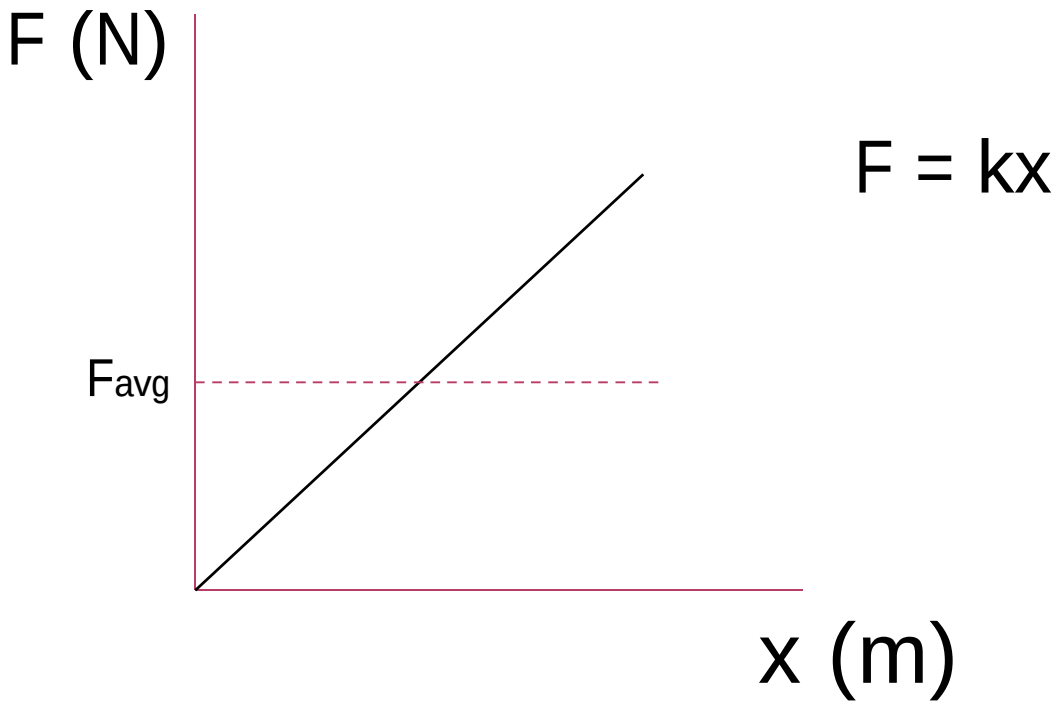
- A spring is a situation with a non-constant force. The more you extend the spring, the greater the force that counters your pull.
- **F = -kx**
- F is the restoring force from the string (N), k is the spring constant (N/m), x is the extension or compression of the spring from the equilibrium position (m).
- The negative sign is because the force acts in the opposite direction to the displacement.
- F = kx is also true, if F is the force YOU apply.

ELASTIC POTENTIAL ENERGY

- Instead of GPE, we have EPE.
- You put energy into the spring, which is stored elastically.
- So EPE = WD in compressing spring.
- **$W = F.d = F.x$**
- Non-constant force, so **$W = F_{avg} . x$**
- **$F_{avg} = ½ (F_f + F_i) = ½ F_f = ½ kx$**
- **So: $W = EPE = ½ kx^2$**

GRAPHS

- If you graph F applied against x, the slope is k.
- Graph should go through the origin.



F = kx

EQUATION SUMMARY

- **$W = F.d$** (or $F.x$)

- **$EPE = \frac{1}{2} kx^2$**
- **$KE = \frac{1}{2} mv^2$**
- **$GPE = mgh$**

- **$F = -kx$**

EXAMPLE SCENARIOS

- A rollercoaster car is moving down a rough (not frictionless) slope.

EXAMPLE SCENARIOS

- A block is pushed against a spring that is attached to a brick wall. When it is released, it travels a short distance before coming to a stop due to friction.

EXAMPLE SCENARIOS

- A cart has a non-zero initial velocity when it begins moving down a rough incline. At the bottom of the incline is a spring, which the cart hits. When the cart comes to a final stop against the spring, that spring remains compressed x meters.

EXAMPLE PROBLEM

- A rollercoaster car falls down a 65 degree drop from rest, travelling a distance of 40 meters. The coefficient of friction between the tracks and the car is 0.2. How fast will the car be going at the bottom?